



INVESTIGATOR'S ANNUAL REPORT

United States Department of the Interior
National Park Service

All or some of the information you provide may become available to the public.

OMB # (1024-0236)
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Reporting Year: 2010	Park: Shenandoah NP	Select the type of permit this report addresses: Scientific Study	
Name of principal investigator or responsible official: Relena Ribbons		Office Phone: 8145743632	
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Additional investigators or key field assistants (first name, last name, office phone, office email) No co-investigators			
Project Title (maximum 300 characters): Forests at southern range margins: implications of climate change for red spruce-fraser fir forests using dendrochronology			
Park-assigned Study or Activity #: SHEN-00376	Park-assigned Permit #: SHEN-2010-SCI-0009	Permit Start Date: May 10, 2010	Permit Expiration Date: Sep 07, 2010
Scientific Study Starting Date: May 10, 2010		Estimated Scientific Study Ending Date: Sep 07, 2010	
For either a Scientific Study or a Science Education Activity, the status is: Suspended		For a Scientific Study that is completed, please check each of the following that applies: <input type="checkbox"/> A final report has been provided to the park or will be provided to the park within the next two years <input type="checkbox"/> Copies of field notes, data files, photos, or other study records, as agreed, have been provided to the park <input type="checkbox"/> All collected and retained specimens have been cataloged into the NPS catalog system and NPS has processed loan agreements as needed	
Activity Type: Research			
Subject/Discipline: Plant Communities (Vegetation)			

Purpose of Scientific Study or Science Education Activity during the reporting year (maximum 4000 characters):

Climate change is dramatically altering forested landscapes across the Northeast, with some communities migrating higher in elevation over the past 40 years (Beckage et al 2008). Boreal forests are most likely to be affected by climate change (Easterling et al 2007). As a result of changing climate tree species are likely to become locally extinct in their southern range margins. Red spruce-Fraser fir (*Picea rubens* & *Abies fraseri*) dominated forests have not been extensively studied at their southern latitudinal limits, where they are most susceptible to climate fluctuations and more easily stressed than in the north. Decreased habitat suitability in lower latitudes may lead species to migrate up a latitudinal or elevational gradient as climate becomes less favorable. Consequently it has been suggested that southern populations may be isolated on mountain tops and disappear completely (Morin et al 2008).

In this research project I will be investigating forest dynamics in southern spruce-fir forests in the Great Smoky Mountains National Park, Shenandoah National Park, the Highlands Biological Station, Pisgah and Nantahala National Forests, and George Washington and Jefferson National Forest. A major component of previous spruce-fir studies in the Great Smoky Mountains has been nutrient

cycling (Johnson et al 1991, Fern et al 1998, Johnson et al 2000), carbon cycling (Van Miegroet et al 2007) and pollution influences on growth (Johnson et al 1984, Webster et al 2004). While several studies have examined spruce decline in relation to climate, these studies have been primarily in the New England region or focused mainly on reporting declining conditions (Reams et al 1993, Silver et al 1994, Johnson et al 1998).

This project will involve two major components: a dendrochronological study as well as a population ecology study. Examining the regeneration layer (seedlings and saplings) in spruce-fir forests is important, as early life-cycle processes in *Picea* spp. and *Abies* spp. have been critical to their success and abundance in forest communities (Greenwood et al 2008). Spruce and fir seed germination are both negatively affected by increased temperatures. This suggests that an increase in temperature may lead to the two species to be less successful at natural regeneration processes (Greenwood et al 2008). Red spruce is used as an indicator species of historic climate conditions, as evidenced by previous tree-ring studies, due to its sensitivity to environmental variables such as temperature. Fraser fir has not been examined as intensively as red spruce. Based on this sensitivity to climate, tree rings from both species will be used to examine the affects of climate change on regeneration and growth. Previous research has generated climate response models (Tang and Beckage 2010) coupled with dendrochronology of red spruce (Cook 1987), which provides a springboard for my research which couples population ecology with dendrochronology.

Statement of Objectives

1. Examine growth rates and climatic sensitivity of red spruce and fraser fir at their disparate portions of their lower range margin, and predict how growth rates will change in the future.
2. Determine if tree species regeneration and vigor have decreased in response to climate changes.
3. Examine the influence of climate change on red spruce-fraser fir forest communities, and predict future composition and potential range shifts.

Findings and status of Scientific Study or accomplishments of Science Education Activity during the reporting year (maximum 4000 characters):

No activity was conducted this report year

For Scientific Studies (not Science Education Activities), were any specimens collected and removed from the park but not destroyed during analysis?

No

Funding specifically used in this park this reporting year that was provided by NPS (enter dollar amount):

\$0

Funding specifically used in this park this reporting year that was provided by all other sources (enter dollar amount):

\$0

List any other U.S. Government Agencies supporting this study or activity and the funding each provided this reporting year:

Paperwork Reduction Act Statement: A federal agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. Public reporting for this collection of information is estimated to average 1.625 hours per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the forms. Direct comments regarding this burden estimate or any aspect of this form to Dr. John G. Dennis, Natural Resources (3127 MIB), National Park Service, 1849 C Street, N.W., Washington, DC 20240.